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ABSTRACT

An experimental course in college teaching for graduate students in engineering and the natural sciences has been offered by the University of Texas at Austin. The program has also included students from a wide variety of academic disciplines. Most of the assignments and activities undertaken have been experientially based, but several tests and supplementary reading materials, which are described, have been used. Students are exposed to various alternatives or supplements to traditional teaching methods such as audiotutorial instructional systems, computer-based or computer-assisted instruction, and Keller's personalized system of instruction. Each student is required to present a half-hour talk to the class pertaining to a teaching method or related topic. Widely used teaching methods such as programmed instruction, discussion methods, laboratory teaching, and the use of demonstrations are also considered. Students complete two courses in media education which teaches students to assemble and run various types of projectors and to make such instructional aids as transparencies, multicolor dittomasters, color-lift transparencies, and slides. One of the most important and effective experiential aspects of the course is microteaching and the feedback it provides. Beginning in the fall of 1973 the course will become a regular offering of the College of Engineering. (SW)

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A COURSE IN COLLEGE TEACHING IN ENGINEERING AND SCIENCE

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MEASUREMENT AND EVALUATION CENTER
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A COURSE IN COLLEGE TEACHING IN ENGINEERING AND SCIENCE

Susan M. Hereford and James E. Stice

ABSTRACT

A graduate course in college teaching is described. The course is being taught by an educational psychologist and a chemical engineer, with assistance from other experts. The rationale, content and activities included in the course are discussed, with particular emphasis on experiential and interactional aspects. The impact of the first year of course development is analyzed. Future plans for this and similar courses at The University of Texas at Austin are surveyed.

A COURSE IN COLLEGE TEACHING IN ENGINEERING AND SCIENCE

Susan M. Hereford and James E. Stice

Engineers receive intensive training to prepare themselves for careers in consulting, private industry and government. Others who require training before they practice their crafts are ministers, social workers, writers, carpenters, physicians, elementary and high school teachers, lawyers and policemen. It is one of the higher mysteries that individuals can spend approximately twenty years preparing themselves for a career in college teaching and enter upon that career with little or no training in how one might go about helping another person or group of people learn.

Several years ago the Dean of Engineering at The University of Texas at Austin was presented with a proposal that the College offer a course in teaching to its graduate students. He submitted the question to his departmental chairmen for discussion, and the proposal was roundly defeated.

In the Fall of 1971 the Dean was again approached, this time with the request that he allow us to send a proposal to the Office of the President of the University for funds to offer an experimental course in college teaching to graduate students in engineering and the natural sciences. He forwarded the proposal through channels, and we shortly learned that the funds had been approved for a trial period of one nine-week summer term. We later submitted an expanded proposal to the Moody Foundation of Galveston, Texas, and they provided funds to offer the course for one calandar year

following the trial period already funded by the University. Thus we had two nine-week summer terms and two regular semesters to develop a course that answered the need we believed existed. If we succeeded, the Dean of Engineering agreed to make the course a regular offering by the College; if we failed, we were out of business.

As of the present, 31 students have been enrolled:

Summer 1972	7
Fall 1972	8
Spring 1973	7
Summer 1973	9

While the course was originally intended for future teachers of engineering and natural science, the students who have participated thus far have represented a wide variety of academic disciplines:

Aerospace Engineering	2
Astronomy	1
Business Administration	1
Chemical Engineering	5
Chemistry	2
Civil Engineering	4
Structures - 1	
Environmental Health - 1	
Architectural Engr. - 2	
Electrical Engineering	3
Hebrew	1
Home Economics	2
Child Development - 1	
Textiles - 1	

Mathematics	1
Mechanical Engineering	4
Biomedical Engr. - 1	
Nuclear Engr. - 2	
Operations Research - 1	
Physics	2
Psychology	1
Speech/Communication	2
	31

During the period of its development, our course in college teaching has undergone continuing modification in response to student interests, needs and backgrounds. It seems improbable that any such course could ever become completely fixed or rigid without losing its basic validity. However, certain content areas, class activities, and instructional methods seem to be valuable to most students regardless of their previous experience or professional plans.

Most of the assignments and activities undertaken by our students are experientially based, for instructional skills cannot be truly learned merely by reading about them. However, we do make use of several texts and supplementary reading materials. The basic text, COLLEGE TEACHING: A SYSTEMATIC APPROACH, by Brown and Thornton (1), presents material pertaining to student characteristics, professional issues in higher education, teaching and learning modes, instructional services and resources, and the evaluation of instruction. The book LEARNING: REINFORCEMENT THEORY, by Fred

Keller (2), provides our students with exposure to some of the established basic principles of learning and motivation. Although systematic behavioral science research is a relatively new endeavor which often seems to yield conflicting results, certain fundamental principles have been established. Films illustrating learning research with human and nonhuman subjects supplement class discussions and readings. Mager's book, PREPARING INSTRUCTIONAL OBJECTIVES (3), presents a strong case for the use of behavioral objectives and instructs students in their preparation. While recognizing that all educational objectives cannot be stated purely in terms of specified observable student behavior, we feel that the value of clarifying objectives should be carefully considered. Other reading materials provide our students with references pertaining to techniques of leading group discussion, principles of test construction, and issues and methods in the evaluation of teaching effectiveness (4, for example). Through library research, the students become familiar with the major reference materials and journals which are relevant to higher education.

Each student enrolled in the course presents a half-hour talk to the class pertaining to a teaching method or related topic. Through such seminar presentations, as well as field trips and guest speakers, our students are exposed to various alternatives or supplements to more traditional teaching methods, such as audiotutorial instructional systems, computer-based or computer-assisted instruction, and Keller's personalized system of instruction. Also considered are more widely used teaching methods such as

programmed instruction, discussion methods, laboratory teaching, and the use of demonstrations. Besides considering the advantages and disadvantages of the various teaching methods, each method is analyzed in terms of the kinds of instructional objectives for which it is generally most appropriate and the principles of learning which it incorporates.

Appropriate use of educational media may enhance almost any teaching method. Therefore, our students complete two courses in media education. Both courses make use of self-instructional workbooks and the students must demonstrate their proficiency to proctors. The course in equipment operation requires students to learn to assemble and run the various types of projectors often used in classroom instruction. In the other course, media production, students learn to make such instructional aids as transparencies (both infrared and diazo processes), multicolor dittomasters, color-lift transparencies, and 2" X 2" slides. Our students complete their media courses early in the term in order that they may use their newly acquired skills in their later assignments and the teaching experiences they have in connection with the course. Another basic course requirement is the preparation of a set of instructional materials. Our students, in fulfilling this requirement, have undertaken such projects as the preparation of a slide series for organic chemistry, the production of an audio-tutorial lesson on the use of the slide rule, the writing of a programmed lesson on the use of the Smith chart in the design of transmission lines, and the preparation of a PSI unit for an introductory reactor theory course. It is our intention that such

projects will not only serve to acquaint students with the variety of techniques available, but that they will also be useful to them in their future teaching.

One of the most important and effective experiential aspects of the course is microteaching and the feedback it provides. Microteaching is a form of role playing in which each student takes a turn at assuming the role of instructor for a brief period of time, while the remaining class members play the role of his students. These miniature lessons may pertain to any topic which the student feels he can cover in the allotted time -- usually ten minutes. Time limits are strictly enforced in order to provide an appreciation of the critical role of timing in effective teaching. Since microteaching is essentially an exercise in communication, the content is secondary to the process of presenting it. An immediate critique follows each presentation, with class members and instructors commenting on the strong and weak points. These sessions are also videotaped in order that the student may view his own performance with the instructors at a later time. The entire process is designed to maximize the amount of constructive feedback received by each individual student.

Microteaching is, of course, only an approximation of actually teaching a class. Three microteaching experiences and feedback sessions precede an actual fifty-minute classroom presentation, which each of our students must make to a class other than one with which they are working as an instructor or teaching assistant. These presentations also are videotaped for later playback and analysis. Still more feedback is obtained from response sheets

completed by students in the class involved. Students are asked to react to the presentation in terms of accuracy, clarity, and interest level and are asked to suggest how the presentation could, in their opinion, have been improved. We have found that the student response sheets provide valuable supplementary information during the videotape playback sessions. Late in the semester, group replay of excerpts from the various classroom presentations allows class members to see and react to one another's teaching in diverse instructional situations.

The development and maintenance of an open and accepting classroom atmosphere is essential for conducting a course such as this effectively. Students generally leave the course with positive feelings toward their group experience and toward teaching. It is our impression that they also leave with enhanced self-awareness and increased sensitivity to the behavior of others--attributes which combine with subject matter expertise and knowledge of instructional techniques to produce effective teaching. In addition to positive student reactions, this course has generated interest throughout the University. Several similar courses in other colleges are presently in the development stage. Furthermore, when we invited faculty members to participate in a similar group this summer, we received affirmative replies from three times the number of individuals we could accommodate. Faculty members who are attending the class this summer include teachers from Classical and Comparative Literature, Industrial Relations, Management Science, Pharmacy, English Literature, Architecture,

English Rhetoric and Composition, Aerospace Engineering, Speech/ Communication, and Architectural Engineering.

Beginning in the Fall semester, 1973, the course described in this presentation will become a part of the regular offerings of the College of Engineering. At this point, it seems reasonable to conclude that, through the support of the Moody Foundation of Galveston and The University of Texas at Austin, we have succeeded in beginning to meet a need which has long existed in higher education.

An impressive amount of research indicates that there is no single "best" way to teach. This does not imply that there isn't a best way for a given person to teach in a given educational situation. One of the major purposes of this course is to provide future college teachers the opportunity to develop insights into human behavior and teaching strategies which will allow him to maximize his own potential for facilitating learning. Galileo said, "You cannot teach a man anything; you can only help him find it within himself." In the same vein, Herbert Spencer said, "What is good teaching? Giving opportunity to the student to discover things by himself." A contemporary writer, Robert Mager (4), said, "If telling were the same as teaching, we'd all be so smart we could hardly stand it."

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